

COLLECTING AND PROCESSING STACK AIR PARTICULATE AND VAPOR SAMPLES FROM TA-53

Purpose This Meteorology and Air Quality Group (MAQ) procedure describes the requirements for changing and processing stack Particulate and Vapor Activation Product (P/VAP) samples on the monitored stacks at TA-53 (Los Alamos Neutron Science Center) as part of the radioactive air emissions monitoring project.

Scope This procedure applies to all MAQ and HSR-1/TA-53 technicians and staff who exchange the stack P/VAP samples or process the samples from monitored stacks at TA-53.

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Procedure**

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Signatures

Prepared by: _____ Carolyn Macdonell, MAQ Rad-NESHAP	Date: <u>02/22/06</u>
Approved by: _____ David Fuehne, MAQ Rad-NESHAP Team Leader	Date: <u>02/22/06</u>
Approved by: _____ Terry Morgan, MAQ QA Officer	Date: <u>02/22/06</u>
Work authorized by: _____ Dianne Wilburn, Acting MAQ Group Leader	Date: <u>02/23/06</u>

03/13/06

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General information about this procedure

Attachments This procedure has the following attachments:

Number	Attachment Title	No. of pages
1	Hazard Review	2
2	Equipment Needed for Exchanging Filters	1

History of revision

This table lists the revision history and effective dates of this procedure.

Revision	Date	Description Of Changes
0	6/2/93	New document, issued as HS-1/TA-53-STACK-DP-001.
1	7/21/94	Updated, and leak test added; issued as ESH-1/TA-53-STACK-DP-404 for inclusion in the HSR-1 site-specific procedure book.
2	7/11/95	Updated and reformatted; FE-16 removed from sampling.
3	5/20/96	Changed document control to AOT-FM (now LANSCE-FM); issued as 53FMP 104-01.3
4	8/13/99	Updated and re-formatted; changed leak test equation to match other leak tests; issued as ESH-17-601, R4.
5	11/01/00	Included access control issues at TA-53 Building 7, Room 200, as well as document change in sample collection date & time. HCP added as Attachment 1.
6	11/01/01	Quick-change fix to references of CFRs, retraining method to "read," and reference to "Chain-of-Custody" form in Attachment 2.
7	12/22/03	Updated to reflect use of new off-site analytical laboratory.
8	2/11/05	Replaced HCP with HR and changed steps for shipping samples near activity limits.
9	03/01/06	Quick-change revision to update DOT shipping requirements.

Who requires training to this procedure?

The following personnel require training before implementing this procedure:

- individual(s) assigned to perform all or part of this procedure
- HSR-1 RCTs who may need to perform unscheduled sample collections

Annual retraining is required and will be by **read** training.

General information, continued

Training method	<p>The training method for this procedure is mentored training by a previously trained individual or subject matter expert and is documented in accordance with the procedure for training (MAQ-024 or HSR1-POL-003).</p> <p>Personnel previously trained to revision 8 of this procedure do not require retraining to this revision.</p>
Prerequisites	<p>In addition to training to this procedure, the following training is also required prior to performing this procedure:</p> <ul style="list-style-type: none">• MAQ-011, “Logbook Use and Control”• PS-13 training “Hazard Communication Introduction” (course # 2398)• Rad Worker training (course # 20301 & associated tests)• Facility Specific Training for unescorted access to TA-53 experimental areas (course #9693)• Limited Access Area training to access the ES-2 stack station in the MEB (course #18825)• Signing the applicable IWD for this work
Definitions specific to this procedure	<p><u>P/VAP</u>: Particulate and Vapor Activation Products; radioactive material, in the form of particulate matter or vapor, that is generated by interaction of the LANSCE ion beam(s) with air or beam line components.</p>
References	<p>The following documents are referenced in this procedure:</p> <ul style="list-style-type: none">• MAQ-011, “Logbook Use and Control”• MAQ-024, “Personnel Training”• MAQ-026, “Deficiency Reporting and Correcting”• MAQ-109, “Collecting Stack Particulate Filter and Charcoal Cartridge Samples”• MAQ-139, “Analytical Chemistry Data Management and Review for RAD-NESHAP Program”• MAQ-612, “Calculating Weekly Particulate and Vapor Radioactive Air Emissions from Sampled Stacks at TA-53”• 40 CFR Part 60, Appendix A, Method 5, Section 4.1.4, “Leak Check Procedures.”
Note	<p>Actions specified within this procedure, unless preceded with “should” or “may,” are to be considered mandatory guidance (i.e., “shall”).</p>

Overview of filter exchange

Overview of filter exchange

This procedure describes the five processes required to perform the particulate and vapor (P/VAP) sample exchange:

- preparation of new filter holders for the upcoming sampling period
- exchange of the filter holders
- removal of the filter material (paper and charcoal filters) from the old holders
- delivery of samples to an off-site analysis lab
- documentation and records resulting from this procedure

Location of filters and vacuum pumps on monitored stacks

There are two monitored stacks at TA-53. Their names and locations are:

- TA-53 Stack Fan Number ES-2, LANL Stack ID TA-53-7-2, is located in MPF-7 (MEB) room 200. The stack P/VAP filter holder is located about four feet above the floor on the west side of the stack. The vacuum pump for this filter is located inside the blue “weather house” immediately west of the stack.
- TA-53 Stack Fan Number ES-3, LANL Stack ID TA-53-3-3, is located outside building MPF-3M on the southwest side up on the stack pad. The filter holder is located just above the elbow coming out of the ground. The vacuum pump is located inside MPF-3M at the 23-foot level, in the center of the west wall (near the “Merrimac” remote-handling unit). Sampling may be discontinued at this stack pending operational conditions.

Frequency of filter exchange

A qualified **MAQ** or **HSR-1/TA-53 technician** exchanges the charcoal and paper filters each Tuesday morning. Typical change time is approximately 6:30 a.m. If HSR-1 is performing the sample changes, the changes may be made at other times to better accommodate shift work scheduling. Dates and times for sample changes may be modified with approval of MAQ staff.

A typical exception to the “Tuesday morning” policy occurs during Tuesday holidays, extended holidays, or other Lab closure. In these situations, exchange samples on the next working day to allow prompt analysis by the analytical laboratory. Extra change cycles may be established as part of maintenance or test activities.

Access to Building 7, room 200. (the ES-2 stack station)

The ES-2 stack station is located in Building 7, room 200 [also called the Mechanical Equipment Building (MEB)]. Due to potential accident scenarios, this building is designated a “Limited Access Area” when beam operating conditions warrant. Entering the MEB during these times requires additional training, and the wearing of an electronic personnel dosimeter (EPD) and a PN-3 dosimeter. Complete access requirements are put forth in the training.

New filter holder preparation

Background

It is necessary to leak check the filter holders each week prior to installation in the system. A small vacuum pump has been set up in the south work area of MPF-3M Room 105 (TOFI) to perform these checks. Since the entire sampling system can have a leak rate of only 0.02 CFM, the filter holders must have a leak rate of no more than 0.01 CFM. The 0.02 CFM leak rate requirement is described in 40 CFR Part 60, Appendix A, Method 5, Section 4.1.4, "Leak Check Procedures."

Steps to assemble and leak test the filter holders

To assemble and leak test the new filter holders, perform the following steps:

Step	Action
1	Collect the first eleven items listed in Attachment 2.
2	Prepare the filters, charcoals, and associated paperwork in the office.
3	<p>Label (alternate pen ink between red and green to uniquely identify each weekly set) each paper filter on the back side (rougher side) with the following information:</p> <ul style="list-style-type: none"> location (Stack ID, e.g. "53000303" or "53000702") Sample run dates (e.g. mm/dd – dd/yy) <p>Prepare a colored label (alternate colors each week between red and green) for the charcoal filter canisters with the same information. Apply the label so flow arrow is visible and label is readable when arrow points down.</p>
4	Begin chain-of-custody paperwork for the prepared samples. See the chapter <i>Chain-of-Custody for Samples</i> (in this procedure, below) for more information. There are separate chain-of-custody pages for each of the two matrices.
5	Prepare a memo to the outside analytical laboratory which states the run dates of the samples, how many samples, and which analyses are required under a LANL purchase order. Forward this memo to the group office for a memo tracking number.
6	Prepare a memo (see example in attachment to MAQ-109) to SUP-3 (LANL Shipping Department) which will state the sample identifying number (Ryymmdd with the yy being the last two digits of the year and the dd being the start day of the sample run), and the maximum radioactivity that could be contained in the shipment (which is calculated via a button in the database). Forward this memo to the group office for a memo tracking number.

Steps continued on next page.

New filter holder preparation, continued

Step	Action
7	Ask the group office for a Shipping Request for the shipment of the samples.
8	Label all plastic bags prior to beginning work to avoid excessive handling of the potentially contaminated filter media. The bags should be labeled with the run date(s) of sampling. Attach a previously prepared label to one of the small baggies, "Count First- 53000702", for use in paper and charcoal filter removal (see below).
9	Take the new filters to the TOFI area for assembly and leak checking.
10	Inspect the filter holder interior and if necessary, remove any foreign material with a Kimwipe and cleaner (e.g., Fantastik™ or Windex™).
11	Lay the paper filter flat in the base of the holder and screw the holder section inlet and paper holder together. Next, put a new charcoal filter in place and screw on the remaining end. Ensure that the flow will be through the smooth side of the filter paper and that the flow direction through the charcoal is as indicated by the arrows on the filter.
12	Install the holder on the vacuum pump system and plug the open end of the holder with the available blank fittings or rubber stoppers.
13	Open the ball valve and start the vacuum pump. Using the needle valve with the round handle, adjust the vacuum to 40-50 inches of water.
14	Shut the ball valve to isolate the filter holder system.
15	Turn off the vacuum pump.
16	Start the stopwatch to begin the leak test. Note the pressure at the start of the leak test (t=0 seconds).
17	After two minutes, check the pressure on the system. If the pressure rise is less than 15 inches of water during the 2 min, assume the filter passes with a leak rate of less than 0.01 actual CFM and skip to step 20.

Steps continued on next page.

New filter holder preparation, continued

Step	Action
18	<p>If the pressure rise is greater than 15 inches of H₂O, calculate the leak rate using this formula and record the results in the stack log book:</p> $Q_{actual}[\text{acfm}] = \frac{\Delta P * V_{system}}{T_{system} * \Delta t * 42.2} * \frac{1 \text{ atm}}{P_{actual}} * \frac{T_{actual}}{273 \text{ Kelvin}}$ <p>Where:</p> <p>Q_{actual} = leak rate (actual cubic feet per minute)</p> <p>ΔP = the difference in pressure between the start and the end of the test time, in inches of water.</p> <p>T_{system} = system temperature, converted to Kelvin by the formula: (T(°F) – 32)/1.8 + 273 = T(Kelvin)</p> <p>Δt = Elapsed time in minutes</p> <p>V = Volume of system being tested, in Liters (7.08 liters, including “buffer” volume of 6.88 L)</p> <p>42.2 = Factor incorporating the ideal gas constant and all unit conversions.</p> <p>P_{actual}, T_{actual} = ambient pressure (in atmospheres) and temperature (in Kelvin) during test.</p> <p>NOTES:</p> <ul style="list-style-type: none"> The 6880 cc buffer volume is included in the volume of the leak test system. The last two terms in the above equation convert standard conditions (1 atmosphere pressure and 273 K temperature) to actual conditions in Los Alamos during testing. For ease in analysis, a standard value of 1.4 can be used in place of the <i>product</i> of these two terms.
19	<p>If the leak rate is above 0.01 CFM, disassemble the holder, inspect, and clean if a cause for the leak can be found. Re-assemble the holder and repeat the leak check starting with step 5. There are a limited number of the holders available, so every effort should be made to find and fix the cause of the leak. If it will not test below the limit, get another holder from available stock (contact the MAQ staff member for assistance if needed). If new parts are used or other major problems are encountered, tag any old or replaced parts and notify the MAQ staff or his/her designee.</p>
20	<p>Repeat leak test (steps 10 -- 19) for the other stack(s) sample assembly(s).</p>

Steps continued on next page.

New filter holder preparation, continued

Step	Action
21	Record in the ES-3 stack logbook the date and time of sample filter tests and result of tests.
22	If the leak rate is less than the 0.01 CFM limit for all sample assemblies, put the prepared assemblies in locked storage, either in MPF-394-105, the TOFI area, or other area designated by MAQ staff.

Filter holder exchange

Steps to exchange the filter holders

Perform the following steps to exchange the filter holders:

Step	Action
1	If operating conditions at ES-2 warrant, wear the PN-3 dosimeter and obtain an electronic personnel dosimeter (EPD) from the TA-53 HSR-1 Field Office personnel. If you are unsure if supplemental dosimetry is required, contact HSR-1 at 667-7069 or the MAQ/LANSCE staff.
2	Proceed to either the ES-2 or ES-3 stack sampling station. At the stack site, don a pair of latex gloves prior to handling the filter assemblies.
3	Locate the inlet side of the filter assembly and disconnect it from the system using the quick connect. The inlet side must be removed first to prevent the loss of material collected on the filters. NOTE: On ES-3, the inlet side is on the <u>bottom</u> of the filter holder. There is a plastic holder for this assembly, beside the system, to contain the sampler while the outlet side is unfastened. On ES-2, the inlet side is on the <u>top</u> of the filter holder.
4	Remove the outlet side of the filter assembly using the quick connect and place this filter assembly inside a plastic bag.
5	Install the new filter sample holder using the quick connects. Either the inlet or outlet end of the filter assembly may be attached first.
6	Prior to leaving TA-53, return to the P/VAP vacuum pump location for that stack, and adjust the flow rate to the value posted at the pump location. Due to slight differences between filter assemblies, the flow rates may change after the assemblies are exchanged.
7	Repeat steps 2-6 for the other stack. Note potential access requirements at the ES-2 station.
8	Proceed with the “removed” filter assemblies to the HSR-1 Source Room for sample media removal.

Paper and charcoal filter removal

Background

Changing the filter materials can be difficult, especially after they have been made leak tight. They should be opened in the HSR-1 source room in building 3R which is controlled for contamination. Care should be exercised when opening the filters to ensure that the filters are kept intact and to minimize the risk of radioactive material loss and cross-contamination.

Steps to remove the filter material

To remove the filters from the filter holders, perform the following steps:

Step	Action
1	Have prepared pre-labeled plastic bags ready for removal of samples.
2	Don latex gloves to prevent contamination. Put down a sheet of mazzlin or plastic on workbench for contamination control.
3	Using strap wrench if needed, disassemble the outlet side of the filter holder and expose the charcoal filter cartridge.
4	Carefully transfer the charcoal cartridges from the holder to a small plastic ziplock bag. If excessive contact is made between gloves and the filter, change gloves. Insert ES-2 cartridge into the bag that is labeled with "Count First- 53000702". This is to alert the analytical lab to begin counting this sample as soon as possible after receipt (because there are a number of nuclides of interest with short half-lives).
5	Remove the inlet half of the filter holder and expose the paper filter.
6	Use tweezers to remove the filter and place it in a glassine envelope and then into a small plastic ziplock bag. Clean the tweezers by wiping them on the gloves being worn or a Kimwipe®.
7	Repeat steps 2-6 for the other stack(s) sample assembly(s). When all samples are collected, put the assemblies back together. Once together, the assemblies are not contamination concerns.
8	Discard mazzlin or plastic sheet into the rad trash box. Remove gloves (turning them inside-out in the process) and dispose of them in the rad trash box, along with any Kimwipes® used.
9	Return the empty sample assemblies to their designated storage area (e.g., TOFI, 53-3M-M105). If desired, the preparation for the following week sample exchange can be performed at this time, according to the chapter "New filter holder preparation" in this procedure.
10	Prior to leaving TA-53 controlled areas, survey your hands and clothes for radiation by self-frisking, a portal monitor, or by contacting an HSR-1 RCT.

Delivering samples for shipping

Background Samples are shipped offsite to an outside analytical laboratory. SUP-3 Materials Management handles the shipping of the samples by overnight FedEx. Based on recent history and expected emissions levels, special handling or shipping is needed only if dose-rate levels at the package surface exceed 0.5 mrem/hr.

Steps for preparation and delivery for shipping To deliver the samples for shipping to an outside analytical laboratory for analysis, perform the following steps:

Step	Action				
1	<p>Prior to submittal, prepare the documents listed below. Examples of these forms are in procedure MAQ-109.</p> <ul style="list-style-type: none"> • “Chain of Custody and Screening Data for Shipping Weekly Stack Samples,” generated by the RADAIR database. • Memo to the analytical laboratory requesting analysis. • Memo to the shipping department. • Express shipping request, available on the LANL web site via the MAQ group office. 				
2	<p>Bag individual samples in small baggies. Place all bagged samples into a large bag for shipping and seal with custody tape.</p>				
3	<p>Have an HSR-1 RCT survey the package.</p> <p>If the dose rate at the surface of the larger baggies is...</p> <table> <tr> <th>≤ 0.5 mrem/hr</th><th>> 0.5 mrem/hr</th></tr> <tr> <td> <ul style="list-style-type: none"> • the package may be shipped via FedEx as a regular package. • Continue with step 4. </td><td> <ul style="list-style-type: none"> • Contact SUP-5 (Special Packaging) for special packaging and shipping protocols. SUP-5 will come to TA-53 to take possession and arrange for shipping. • Sign chain-of-custody to transfer possession to SUP-5. • Copy all paperwork for MAQ records. • Do not continue with steps below. </td></tr> </table>	≤ 0.5 mrem/hr	> 0.5 mrem/hr	<ul style="list-style-type: none"> • the package may be shipped via FedEx as a regular package. • Continue with step 4. 	<ul style="list-style-type: none"> • Contact SUP-5 (Special Packaging) for special packaging and shipping protocols. SUP-5 will come to TA-53 to take possession and arrange for shipping. • Sign chain-of-custody to transfer possession to SUP-5. • Copy all paperwork for MAQ records. • Do not continue with steps below.
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4	<p>Review the chain of custody for proper completion and transfer the samples to FedEx for shipping. Perform V&V on the sample shipment and initial and date the c-of-c form.</p>				
5	<p>Transport the samples to the shipping department at SM-30.</p>				
6	<p>Prepare the FedEx shipping box. Have SUP-3 personnel make copies of all documents to accompany samples.</p>				
7	<p>Place samples in shipping box. Place original documents inside pre-prepared large baggie and into shipping box. Seal box and hand off to SUP-3 personnel. FedEx will pick up box for delivery.</p>				

Chain-of-custody for samples

Maintaining custody of samples

A sample is physical evidence collected from a facility or the environment. Chain-of-custody must be documented for all samples used to demonstrate compliance. Verify that the possession and handling of samples is traceable at all times. A sample is considered in custody if it is one of the following:

- In one's physical possession.
- In one's view after being in one's physical possession.
- In one's physical possession and then locked up so that no one can tamper with it.
- Kept in a secure area where access is restricted to authorized and accountable personnel only.

NOTE: A secured area is an area that is locked, such as a room, cooler, vehicle, or refrigerator. If the area cannot be secured by locking, use a custody seal to secure the area or the sample container.

Procedure MAQ-109 has more information and samples of forms that can be used for initiating chain of custody.

Transferring custody of samples

Whenever samples are transferred into the custody of another person or organization, complete the "relinquished by/received by" and "date" sections of the form. These sections of the form must provide a complete history of custody of the samples from collection to transfer to the analytical laboratory.

If chain-of-custody is broken

Whenever there is a break in the chain of custody of a sample, document the failure by initiating a deficiency report in accordance with the procedure for deficiencies (MAQ-026). [The deficiency process will document the occurrence, evaluate the potential impact (if any) on the samples, and propose a fix to prevent recurrence.]

Records resulting from this procedure

Records

The following records generated as a result of this procedure are to be filed **within one week** in the location indicated:

- entries in the stack logbook.
- chain-of-custody forms, shipping paperwork, and field data for the filters/charcoals in the MAQ records room.

[Click here to record “self-study” training to this procedure.](#)

HAZARD REVIEW FOR COLLECTING AND PROCESSING STACK AIR PARTICULATE AND VAPOR SAMPLES FROM TA-53

Work tasks/Steps	Hazards, Concerns, and Potential accidents; Likelihood/ Severity	Controls, Preventive Measures (e.g., safety equipment, administrative controls, etc.)	Hazard Level from IMP 300-00-00 Hazard Grading Matrix
Collect stack filter samples according to steps in this procedure.	See relevant IWD for each facility where samples are collected.	See relevant IWD for each facility where samples are collected.	Moderate
Handle charcoal sample cartridges	Health effects from ingestion or breathing charcoal. remote / moderate = minimal	charcoal: avoid breathing in such material; do not break open the individual charcoal cartridges	Low

Wastes or residual materials resulting from process

Gloves, Kimwipes®, mazzlin, gaskets, o-rings, and possibly other low-level rad trash. Dispose in facility rad trash.

Emergency actions to take in event of control failure

For all injuries, provide first aid and see that injured person is taken to Occupational Medicine (only if immediate medical attention is not required) or the hospital. Notify supervisor and group office as soon as possible. For any exposed, energized electrical wires, contact an electrician or the appropriate authority to turn off the power. Follow all site-specific emergency plans for any radiation or explosives emergencies.

EQUIPMENT NEEDED FOR EXCHANGING FILTERS/CARTRIDGES

Quantity	Item
2 ea.	Two inch LB-5211 (or equivalent) paper filters
2 ea.	Hi-Q 5211-20 TEDA (or equivalent) impregnated carbon cartridges
2 ea.	Glassine envelopes for paper filters.
4 ea.	Small plastic zip lock bags (4"x4") for individual sample filters and cartridges
2 ea.	Medium plastic zip lock bags for holding the two each same matrix samples
2 ea.	Large plastic zip lock bags. One to hold the two medium sample bags. One to hold the paperwork.
1 ea.	Chain of Custody Security Tape
1 ea.	Previously prepared label "Count First- 53000702"
2 ea.	Stack Sample Data Form and Chain-of-Custody Record (see MAQ-109).
1 ea	Red or green permanent ink pens
1 ea	Red or green labels
multiple pairs	Disposable gloves, standard anti-contamination PPE-style
1 ea.	Tweezers
1 box	Mazzlin
1 ea.	Spray cleaning solution (e.g., Windex™ or Fantastic™)
1 box	Paper Lab wipes, e.g, Kimwipes™
1 ea.	Stopwatch or timer
1 set	Tools - including strap wrench and pliers
1 ea.	Calculator
1 ea.	GM beta/gamma portable survey meter (either 14C or ESP-1). This instrument is available in the HSR-1 sample room for use by HSR-1 or MAQ personnel.